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NRL Memorandum Report 381

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PROJECT CLINKER
HYDRAULIC CARRIAGE FOR AIRSHIP INSTALLATION OF OPTICAL EQUIPMENT (U)

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OPTICS DIVISION

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ABSTRACT

Airship installation of delicate optical equipment often requires special rigging equipment not available commercially. One problem at this Laboratory called for the installation of an 8.5-foot-diameter mirror, weighing nearly 2000 pounds, in a type ZPM-4 airship. The mirror was required to pass beneath a conical windscreen having a 5-foot clearance above the ground and be mounted within the screen at an angle of 45 degrees.

One answer to this problem was a carriage having a top deck pivoted at one end. The movable deck was raised to the required angle by a motor driven hydraulic hoist of the type used commercially for dump trucks. The mirror was mounted on this movable deck by means of a wooden cradle which could then be drawn up the incline into position for installation in the airship. The inclined deck contains steel rollers to reduce friction and the cradle moves upward by means of an electric chain hoist.

This hydraulic carriage was used successfully in many operations involving installation and removal of the mirror and resulted in a great saving of man-hours of rigging time.

PROBLEM STATUS

This is an interim report on the problem; work on this problem is continuing.

AUTHORIZATION

NRL Problem N03-01
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Bureau NRL-EL-8-345

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PROJECT CLINKER

HYDRAULIC CARRIAGE FOR AIRSHIP INSTALLATION OF OPTICAL EQUIPMENT

INTRODUCTION

Airship installation of delicate optical parts often requires special equipment to insure safety and ease of handling. In particular, when these parts are large and heavy and are mounted externally to the airship, commercial lift trucks are frequently unsuited to the work. One problem at this Laboratory called for the installation of an 8.5-foot-diameter mirror, weighing nearly 2000 pounds, in a type ZPM-4 airship. A project had been established at the Naval Air Station, Lakehurst, for the modification of this airship to receive this NRL equipment.

The mirror was to be mounted on an angle of 45 degrees by means of a cylindrical casting having one right angle base for attachment to the airship and one 45-degree base for attachment to the mirror back-up structure. The entire assembly was to be mounted inside a conical wind screen 30 feet in diameter at the base. Clearance beneath this cone, when the airship was moored in a horizontal position, was approximately five feet. One answer to this problem was a carriage meeting the following requirements.

(a) It must support the mirror in a horizontal, face-down position with low enough vertical clearance to pass beneath the screen.

(b) It must have a movable deck hinged or pivoted at one end for raising the mirror to the required 45-degree angle.

(c) It must have provision for hoisting the mirror up the incline to the required mounting height.

(d) It must use commercial equipment whenever possible since the operational nature of the installation put time limits on the design of this unit.

After consideration of many alternatives, it was decided to utilize a dump truck principle (1) to raise the equipment to the required angle. A commercial dump truck hoist, powered by a 5-hp motor, was mounted in a heavy base constructed of angle iron. The base was rigidized with "I" beam cross members and mounted on casters. A one ton capacity

electric chain hoist was utilized to pull the mirror up the incline. Figure 1 is a schematic drawing which illustrates the use of the hydraulic carriage to install this optical equipment in the airship.

The carriage was tested both at the Laboratory and in the field and performed satisfactorily using a 3000-pound test load. Use of the carriage on numerous occasions for installation and removal of the mirror indicates that improvements could be made in providing a finer adjustment for the hydraulic hoist unit. Despite this drawback, the hydraulic carriage has proved a very useful tool for airship installation of this optical equipment.

EQUIPMENT

Hydraulic Hoist Unit. Figure 2(a) shows a view of the carriage in the lowered position. Over at the extreme right can be seen the conical screen attached to the airship. A wooden cradle or skid, with mounting blocks shaped to the contour of the mirror, lies on the roller deck of the carriage. Two men are required for operation of this carriage, one to handle the controls, and the other to insert the braking bars when the roller deck is raised. In this view, one operator holds the push-button control for the chain hoist, while at his left can be seen the control lever for the hydraulic unit.

Figure 2(b) shows the carriage with the roller deck in the raised position. The hydraulic unit (2) is clearly visible. The S-shaped side rails of the hoist which would normally be attached to a dump truck body have been welded to 2 pieces of 6-inch channel iron, running the entire length of the roller deck. The hoist is supported by six "I" beams, 6 inches in height, running crosswise to the hoist and welded to a 4 x 4-inch angle iron frame. Nine steel casters, 12 inch in diameter, support the carriage and allow it to move easily in any direction.

The hoist unit has a capacity of 5 tons when used with a truck body length of 14 feet. Here the body length is 16 feet but its load is evenly distributed about a center of gravity approximately 12 feet from the pivot point when the wood skid is raised to the limit of its travel. Thus, the capacity is lowered to about 3 tons, giving a factor of safety of 3 when used with a load of less than 1 ton.

The hydraulic cylinder has a 7-inch-diameter bore and a 15-inch stroke and uses number 10 motor oil as fluid. A lever-operated three-way control valve permits raising, lowering or holding at any point. A 5-hp gearmotor (3), which is visible to the left of the switch box, drives the hydraulic pump with an output speed of 520 rpm.

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Electrical Hoist Unit. Mounted near the top of the roller deck, Figure 2(b), is an electric chain hoist (4), one ton capacity, which is used to draw the wood skid up the incline. This hoist is push-button controlled and uses a 1/2-hp motor. The speed of travel up the incline is constant at 9 feet/minute.

Figure 2(c) shows the hydraulic carriage in the raised position with the wood skid drawn up to the limit of its travel. A preset lock mechanism in the chain hoist stops the wood skid at the end of the roller deck and prevents damage to the airship during assembly. Sockets are provided for braking bars which are used to lock the roller deck in position when it has been raised to the 45-degree angle. These bars, which are not shown in the picture, are made of 2-inch-diameter steel pipe and have a screw-thread adjustment at one end to permit slight variation of height. Metal rails are attached to the wood skid and these ride on 1.5-inch-diameter steel rollers, 58 in all, which are attached to the roller deck.

CONCLUSION

This hydraulic carriage has proved its value on many separate occasions for installing and removing optical equipment. It has saved many man-hours of rigging which would otherwise be required. Above all it has insured the safety of expensive and delicate optical equipment, which in this installation, is a paramount consideration.

ACKNOWLEDGMENT

The authors of this report are indebted to Mr. William Stogner of the Sheet Metal Shop, Engineering Services Division, who was of great assistance in the fabrication of the carriage and who suggested many useful mechanical features to improve its operation.

* * *

REFERENCES

1. Credit for this idea, which made the whole design feasible, goes to Mr. Rosenberg, co-author of this report.

2. This unit is a model 1715 Twin Arm Conversion Hoist purchased from the Heil Equipment Company of Washington, D. C.

3. Purchased from Louis Allis Company, Milwaukee, Wisc.

4. "Comet" Model, purchased from Chisholm-Moore Hoist Corp., Tonawanda, N. Y.

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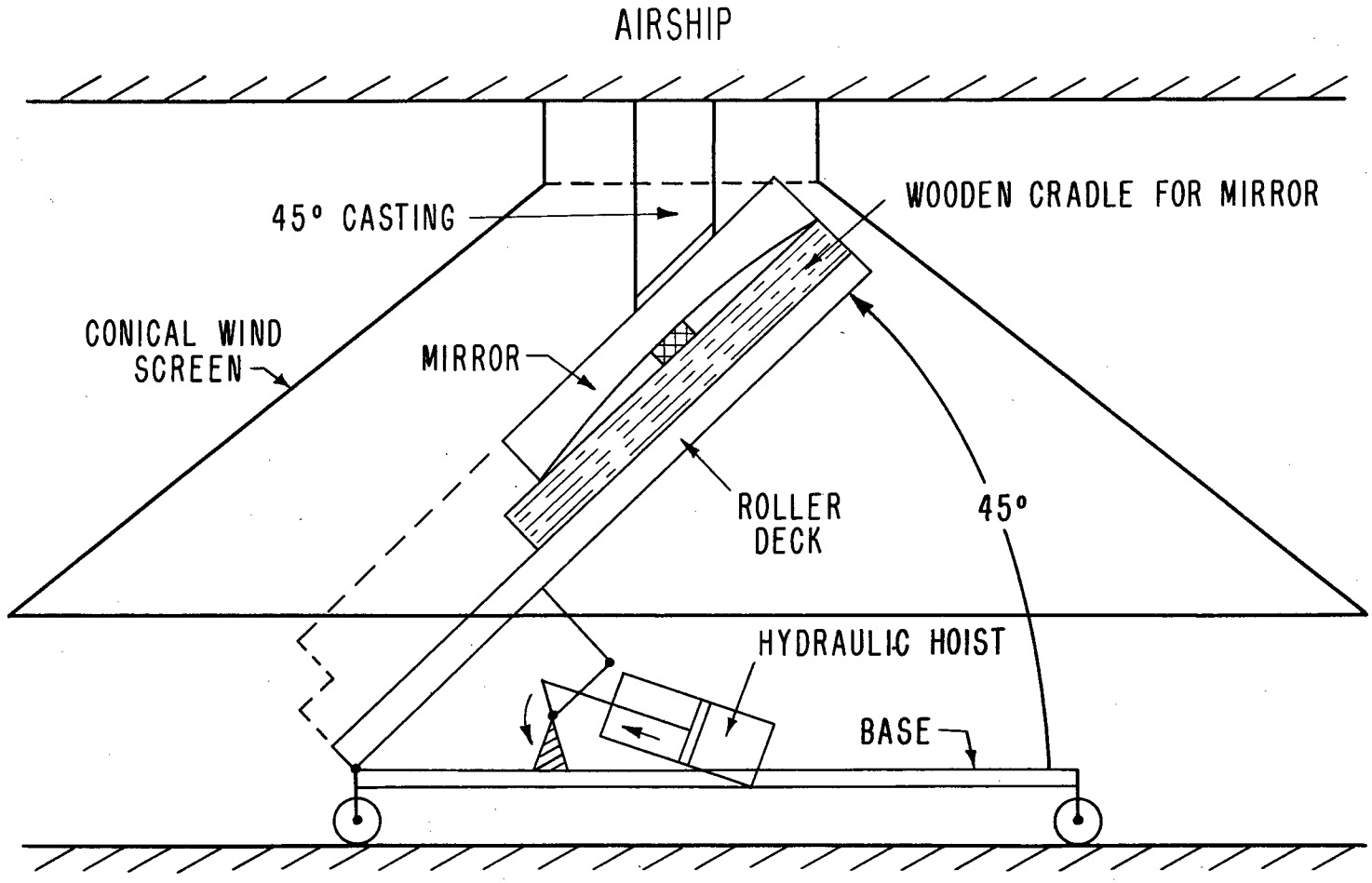

FIG. I SCHEMATIC DRAWING SHOWING USE OF HYDRAULIC CARRIAGE TO INSTALL MIRROR IN AIRSHIP

Figure 2(a)

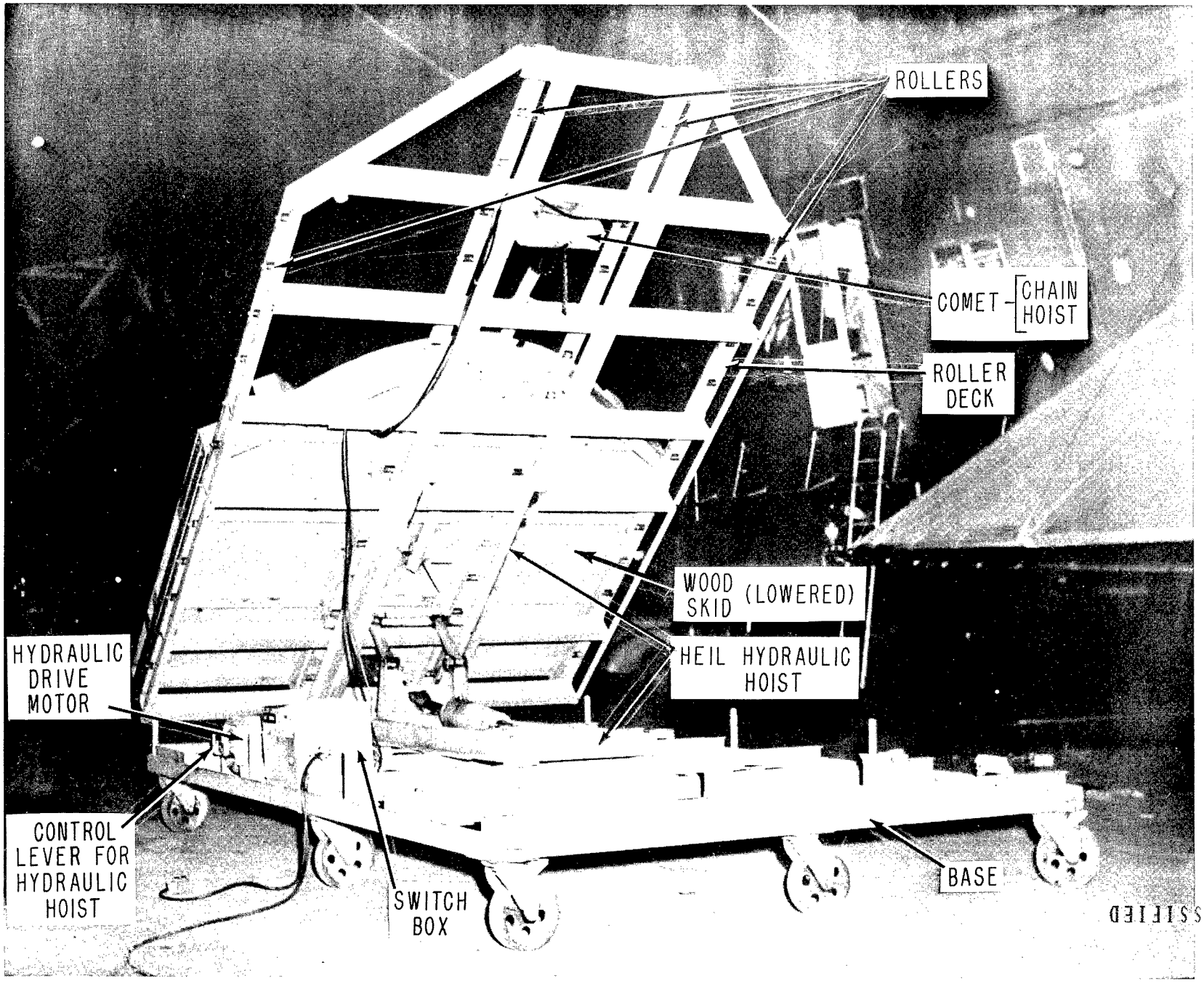

Figure 2(b)

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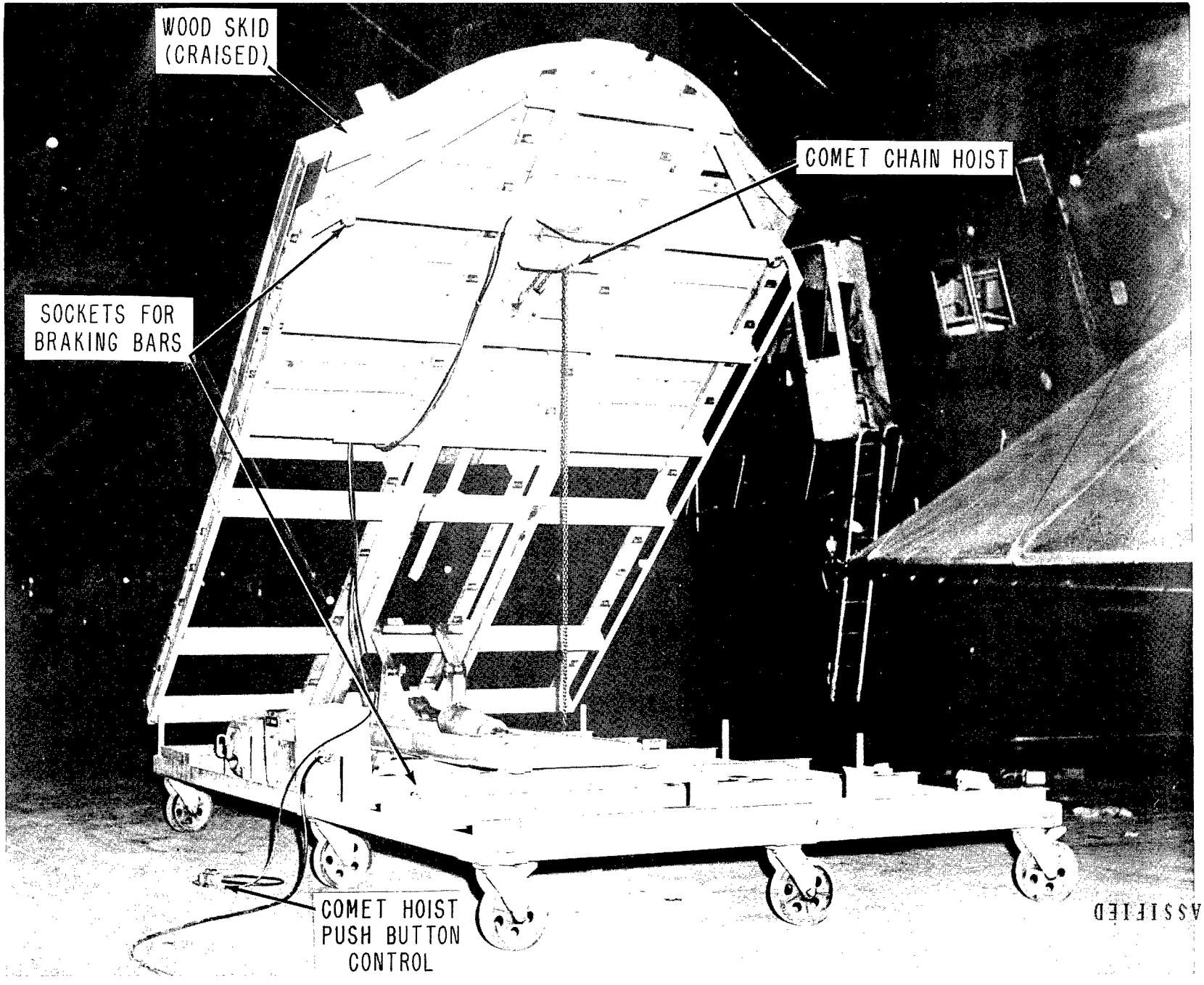

Figure 2(c)